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ABSTRACT

During this quarter, planning was begun on a field experiment to determine the effectiveness of the Lincoln Training System (LTS) for maintenance management. Work continued on the development and evaluation of fiche handling mechanisms for the LTS-4. (Author)

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Quarterly Technical Summary

Educational Technology Program

15 September 1972

Prepared for the Department of the Air Force
under Electronic Systems Division Contract F19628-73-C-0002 by

Lincoln Laboratory

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Lexington, Massachusetts

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ABSTRACT

Planning has begun on a field experiment to determine the effectiveness of the LTS for maintenance management. This project is supported by the Air Force Communications Service and is made possible by the completion of our LTS-3S stand-alone terminal development.

Work continues on the development and evaluation of fiche handling mechanisms for the LTS-4.

15 September 1974

F. C. Frick
Program Manager

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EDUCATIONAL TECHNOLOGY PROGRAM

I. INTRODUCTION

The LTS-3S terminal has been brought to a point of reasonable reliability and ruggedness, where it appears feasible to use these terminals for field experimentation or author support and formative evaluation of instructional material. A detailed maintenance manual and spare parts list has been prepared.

A new operating system, adaptable to either training or maintenance management, has been developed for the LTS-3S. It will also serve as the initial version of an operating system for the LTS-4. A "breadboard" version of the author-support and lesson checkout facility is now in operation, and an initial set of author programs has been developed.

These developments have made it possible to initiate work on a field experiment to determine the effectiveness of the LTS for maintenance management. This project is supported by the Air Force Communications Service and will involve using an LTS-3S to monitor performance measurement and maintenance of the AN/TRC-97A mobile radio set.

Work on the LTS-4 terminal has focused on characterizing and evaluating various means for fiche selection and positioning. At the present program funding level, this will be the chief concern of our terminal development program for the next two quarters.

II. LTS SOFTWARE DEVELOPMENT

A complete software support system for generating frame logic for the LTS-3S has been placed in operation. The operating system that supports services to the student that are common to all frames has been completed. An initial set of programs that the author invokes to provide special services to the student on a frame have been written, debugged, and documented. Of special interest is the fact that these embody a system of modularizing lessons which permits one author to incorporate another author's material in his lesson without copying the frames on new fiche cards. A simplified procedure for inserting author code, the branching table, and other data that condition running of the frame program has been found successful. It replaces a cumbersome technique involving the traditional editor/assembler approach. The PDP-8 lesson checkout facility that simulates running the lesson logic on LTS in all respects is in operation. New programs tested first on the lesson checkout facility have subsequently run perfectly on the LTS-3S machine itself.

Programming for LTS-3S has been completed except for occasional generation of new frame programs at author request. Activity in the software area will shift to lesson development in the next quarter.

III. LTS HARDWARE DEVELOPMENT

Work has continued on the checkout and characterization of the cam-driven fiche selector. The column control system has been redesigned, and the fiche selection and row and column positioning systems may now be exercised by the manual control panel. The design of the belt-driven fiche selector and its associated cassette tilting mechanism is essentially complete, and parts are being released for fabrication.

A new process camera has been added to our fiche production facility. This installation represents a step forward in the development of a deployable facility.

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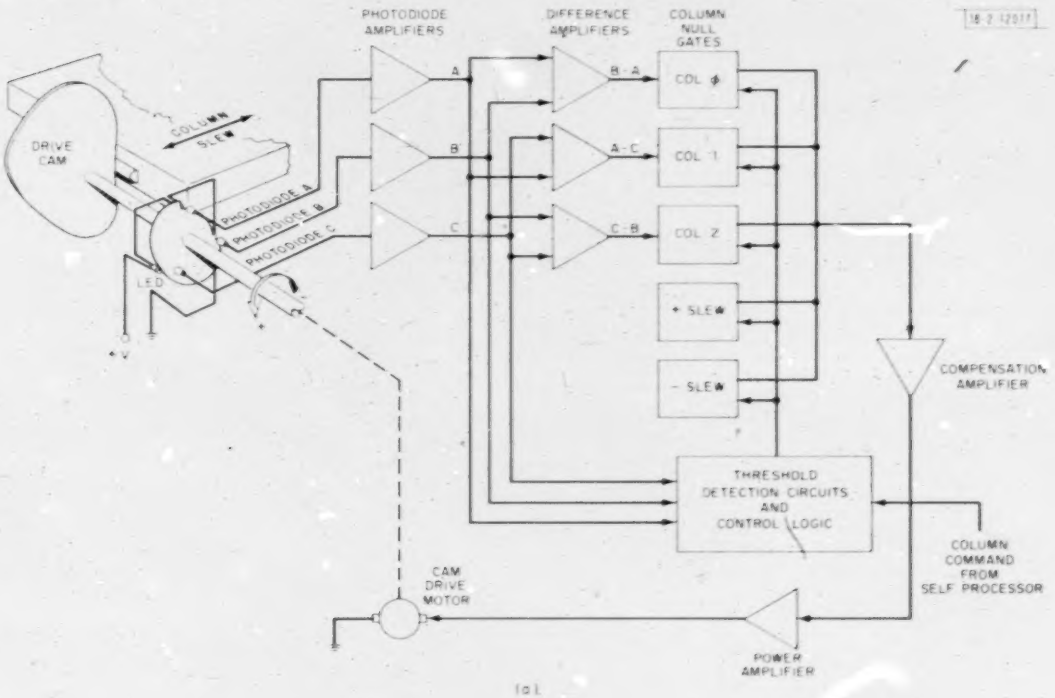
A. LTS-4 Electromechanical Subsystems

Work on the electromechanical sensing and control logic has progressed during the past quarter such that all positioning systems may now be exercised by the manual control panel. Operational tests of the cam-driven cassette carriage with its associated spring return indicated that this scheme presents a complex closed-loop compensation problem due to the variable inertial loading of the cam and spring-loaded follower combination. The column control [Fig. 1(a)] was redesigned to permit open-loop slewing until the threshold detection circuits indicate that the cassette carriage is positioned at the selected column. When the selected column is detected, the loop is closed to fine position the carriage in column such that it stops within range of the pin. This design will be compatible with the alternate belt-driven column selection system described in the next section. The row positioning system shown in Fig. 1(b) establishes the desired row location by sensing fiducial marks on the fiche as it is driven in or out of the cassette. The control cycle is essentially the same as that described for column positioning wherein the rollers drive the fiche open loop until the selected row position is detected and then the loop is closed to position the fiche within range of the pin. The fiche select system shown in Fig. 1(c) requires that the cassette be in column one when the fiche select hammer is activated due to the fact that the hammer carriage mechanism is located at mechanical ground. This requirement is eliminated for the belt-driven cassette chassis design because the fiche selector is an integral part of the cassette tilting mechanism and is located on board the cassette carriage.

Future work will be directed toward refining and characterizing the present fiche manipulation system while the alternate belt-driven system is being fabricated, since many of the mechanical assemblies are common to both systems. The associated electronics is being modified such that it can be interfaced to either fiche manipulation scheme for cycle testing.



(a)

Fig. 1(a). Column positioning system.

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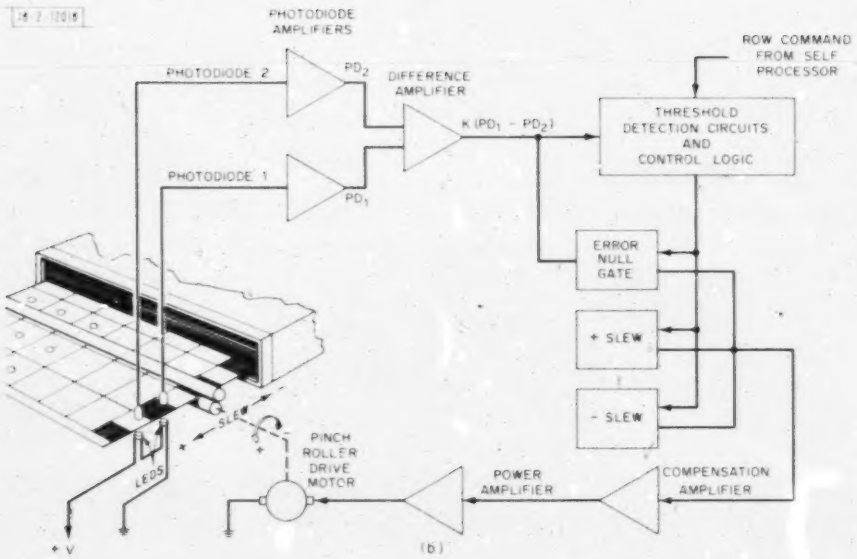

Fig. 1(b). Row positioning system.

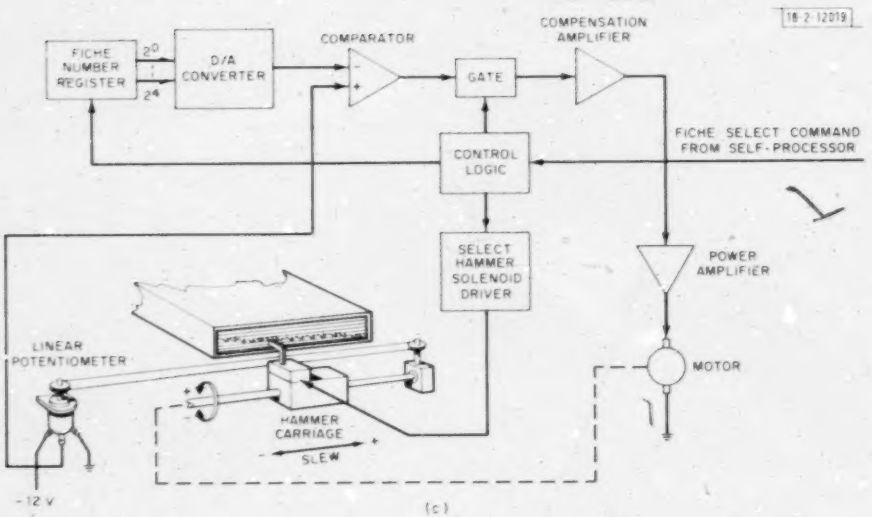

Fig. 1(c). Fiche select system.

B. LTS-4 Mechanical Subsystems

The design of the belt-driven cassette carriage with its associated tilting mechanism has been completed, and the parts are being ordered. The main frame is now a single casting instead of an assembly of machined parts and in any quantity will be cheaper than the cam-driven assembly now being tested. As described in Section III-A, the fiche select carriage is now mounted on board the cassette carriage and is belt driven. This scheme will also be less expensive than the roh-lix drive used in the present system.

Driving the cassette carriage with a belt instead of a cam permits constant coupling of the load to the motor, that is, a spring return is no longer necessary since the belt is capable of driving the load in both directions. When the cassette is driven by a cam, the carriage does not follow the motor directly but does so as a function of the cam profile. For a single cam system, a spring is used to drive the carriage in the opposite direction. Therefore, the motor drives the spring and the inertial load of the carriage in one direction, and in the other direction the carriage is driven by the spring and therefore the motor is loaded only by its gear train and the cam. For the belt-driven system, the motor will experience a constant inertial load and the transient response of the closed-loop servo system will be the same regardless of the direction of carriage travel.

The construction of the envelope punch facility has been completed. Envelopes punched with larger holes than the enclosed fiche have been successfully accessed and positioned with the cam-driven fiche manipulator.

C. Film Production

A new process camera has been added to our film production facility for photographing materials for video frames. This commercial equipment replaces the experimental configuration that had been used in the past. This installation represents a step forward in the development of a streamlined fiche production facility which will be deployed in lesson preparation centers. A comparison of the old and new systems is depicted in Table I.

TABLE I
COMPARISON OF CAMERA SYSTEMS

Comparison Basis	Old	New
Visual art size	$8\frac{1}{2} \times 11$ inches	Any size to 21 × 25 inches
Film size	8 × 10 inches	Any size to 14 × 18 inches
Size ratio	2.3 × reduction	3 × reduction to 2 × magnification
Lighting system	2 fluorescent lamps	4 400-watt quartz iodide lamps
Exposure control	Hand-cable release	Preset timer
Construction	Assembled from parts	One self-contained unit

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Planning has begun on a field experiment to determine the effectiveness of the LTS for maintenance management. This project is supported by the Air Force Communications Service and is made possible by the completion of our LTS-3S stand-alone terminal development.

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